

DREW UNIVERSITY

ARNOLD L. DEMAINE, Ph. D.

Fellow in Microbial Biochemistry

Charles A. Dana Research Institute (R.I.S.E.)

HS-330

Madison, N.J. 07940, U.S.A.

Tel. 973-408-3937

Fax. 973-408-3504

Email: ademain@drew.edu

A. PROFESSIONAL AND ACADEMIC ESSENTIALS

Education:

1949, 1950 B.S. & MS, Michigan State University Bacteriology
1954 Ph.D., University of California (Davis and Berkeley),
Microbiology

Experience:

1954-1964 Merck & Co, Research Microbiologist
1965-1969 Merck & Co, Founder and Head, Department of Fermentation
Microbiology
1969-2001 M.I.T., Professor of Industrial Microbiology
2001-present Drew University, Fellow, Charles A. Dana Institute for Scientists Emeriti

Honors:

1978 Charles Thom Award, Society for Industrial Microbiology
1979 Rubbo Oration Award, Australian Society for Microbiology
1980 First David Perlman Memorial Lecture Award, American
Chemical Society
1981 Fellow, American Academy of Microbiology
1985 Honorary Member of the Kitasato Institute, Tokyo
1985 Fellow, Society for Industrial Microbiology
1986 Chair, International Committee on Economic and Applied
Microbiology
1987 Senior U.S. Scientist Humboldt Foundation Prize from the
Federal Republic of Germany
1987 Fellow of the International Institute of Biotechnology, UK
1988 Microbial Chemistry Medal from Kitasato Institute, Tokyo
1989 Award of the Italian Industrial Pharmaceutical Association
1990 First Hans Knoll Memorial Medal, Academy of Science of GDR
1990 Biotechnology Award, American Society for Microbiology
1990 President, Society for Industrial Microbiology
1993 Honorary Member, Societe Francaise de Microbiologie
1994 American Society for Microbiology Distinguished Service
Award
1994 Elected to membership in National Academy of Science, USA
1994 Waksman Outstanding Teaching Award, Society for Industrial
Microbiology
1995 Honorary Membership, Society for Actinomycetes Japan (SAJ)
1996 Corresponding Member, Mexican Academy of Sciences
1997 Doctor Honoris Causa, University of Leon, Spain
1997 Marvin J. Johnson Award in Microbial and Biochemical
Technology, American Chemical Society
1997 Dedication Award, 5th International Conference on the
Biotechnology of Microbial Products: Novel Pharmacological and
Agrobiological Activities (Williamsburg, VA)
1997 Special Award of the Society for Fermentation & Bioengineering
of Japan
1998 Alice Evans Award, American Society for Microbiology

1998:	Andrew Jackson Moyer Lectureship Award, NCAUR, US Dept. Agriculture, Peoria
1998	G. J. Mendel Honorary Medal of the Czech Academy of Sciences for Merit in the Biological Sciences
1998	Honorary Membership, Czechoslovak Society for Microbiology
1999	Doctor Honoris Causa, Ghent University, Belgium
1999	Honorary Membership Award, Northeast Branch of American Society for Microbiology
1999	Medal of the Order of the Rising Sun, Imperial Decoration Award of Japan
2000	Elected to Board of Governors of American Academy of Microbiology
2000	Honorary Doctorate from Technion (Israel Inst. Technology)
2000	Honorary Doctorate from Michigan State University
2000:	Appointed, Advisory Committee of the Korea Research Institute of Bioscience and Biotechnology
2002	Appointed, Advisory Committee of the University of Iowa Center for Biocatalysis and Bioprocessing
2002	Elected to Hungarian Academy of Science
2003	Honorary Doctorate, University of Muenster, Germany
2003	Re-elected to Board of Governors of American Academy of Microbiology
2005	Arima Award in Applied Microbiology from the International Union of Microbiological Sciences (IUMS)
2005	Shanghai Institute of the Pharmaceutical Industry International Achievement Award
2005	SynerZ Lifetime Achievement Award

Editorial Activities:

Editor, Editorial Board, or Advisory Board of 34 journals & book series; 23 in
past; 11 currently.

Books:

Co-Editor or co-author of 11 books.

Patents:

21 US Patents.

B. 495 Publications including: Paiva, Demain and Roberts, The immediate precursor of the nitrogen-containing ring of rapamycin is free pipelicolic acid. *Enzyme Microb. Technol.* 15, 581 (1993). Paiva, Roberts and Demain, The cyclohexane moiety of rapamycin is derived from shikimic acid in *Streptomyces hygroscopicus*. *J. Ind. Microbiol.* 12, 423 (1993). Kobayashi, Romaniec, Barker, Gerngross & Demain, Nucleotide Sequence of Gene *celM* Encoding a New Endoglucanase (CelM) of *Clostridium thermocellum* and Purification of the Enzyme. *J. Ferm. Bioeng.* 76, 251 (1993). Gerngross, Romaniec, Kobayashi, Huskisson & Demain, Sequencing of a *Clostridium thermocellum* Gene (*cipA*) Encoding the Cellulosomal SL-Protein Reveals an Unusual Degree of Internal Homology. *Molec. Microbiol.* 8, 325 (1993). Paiva, Demain and Roberts, The immediate precursor of the nitrogen-containing ring of rapamycin is free pipelicolic acid. *Enzyme Microb. Technol.* 15, 581 (1993). Paiva, Roberts and Demain, The cyclohexane moiety of rapamycin is derived from shikimic acid in *Streptomyces hygroscopicus*. *J. Ind. Microbiol.* 12, 423 (1993). Romaniec, Huskisson, Barker & Demain, Purification and Properties of the *Clostridium thermocellum* *bglB* Gene Product Expressed in *Escherichia coli*. *Enzyme Microb. Technol.* 15, 393 (1993). Nochur, Roberts & Demain, True Cellulase Production by *Clostridium thermocellum* Grown on Different Carbon Sources, *Biotechnol. Lett.* 15, 641 (1993). Lin and Demain, Resting cell studies on formation of water-soluble red pigments by *Monascus* sp. *J. Ind. Microbiol.* 12, 361 (1993). Demain, Turning Garbage into Motor Fuel: Fanciful Dream or Feasible Scheme? In: *Genetics, Biochemistry and Ecology of Lignocellulose Degradation* (Shimada et al., eds) pp 573-583, Uni, Tokyo (1994). Lin and Demain, Leucine interference in the production of water-soluble red *Monascus* pigments. *Arch. Microbiol.* 162, 114 (1994). Lin and Demain, Negative effect of ammonium nitrate as nitrogen source on the production of water-soluble

red pigments by *Monascus* sp. Appl. Microbiol. Biotechnol. 43, 701 (1995). Kruus, Lua, Demain & Wu, The Anchorage Function of CipA (Cell), a Scaffolding Protein of the *Clostridium thermocellum* Cellulosome. Proc. Natl. Acad. Sci., USA 92, 9254 (1995). Cheng, Hauck and Demain, Phosphate, ammonium, magnesium and iron nutrition of *Streptomyces hygroscopicus* with respect to rapamycin production. J. Ind. Microbiol. 14, 424 (1995). Kojima, Cheng, Mohan and Demain, Carbon source nutrition of rapamycin biosynthesis in *Streptomyces hygroscopicus*. J. Ind. Microbiol. 14, 436 (1995). Cheng, Fang and Demain, Effect of amino acids on rapamycin biosynthesis by *Streptomyces hygroscopicus*. Appl. Microbiol. Biotechnol. 43, 1096 (1995). Demain, Microbial secondary metabolism: the new frontier. In: Sekundärmetabolismus bei Mikroorganismen. Beiträge zur Forschung (W. Kuhn and H.-P. Fiedler, eds.) pp. 9-35. Attempto Verlag, Tübingen (1995). Fang and Demain, Dependence of nitrogen- and phosphorus-regulation of β -lactam antibiotic production by *Streptomyces clavuligerus* on aeration level. J. Indust. Microbiol. 15, 407 (1995). Demain and Fang, Emerging concepts of secondary metabolism in actinomycetes. Actinomycetologica 9, 98 (1995). Fang and Demain, Exogenous shikimic acid stimulates rapamycin biosynthesis in *Streptomyces hygroscopicus*. Folia Microbiol. 40, 607 (1995). Klapatch, Demain and Lynd, Restriction endonuclease activity in *Clostridium thermocellum* and *Clostridium thermosaccharolyticum*. Appl. Microbiol. Biotechnol. 45, 127 (1996). Cochet and Demain, Effect of water activity on production of β -lactam antibiotics by *Streptomyces clavuligerus* in submerged culture. J. Appl. Bacteriol. 60, 333 (1996). Xiao, Hintermann, Demain and Piret, Evidence for the presence of β -lactamase in *Streptomyces glaucescens* and its inhibition by sodium clavulanate. J. Indust. Microbiol. 16, 261 (1996). Demain, Klapatch, Jung and Lynd, Recombinant DNA technology in development of an economical conversion of waste to liquid fuel. Ann. NY Acad. Sci. 782, 402 (1996). Demain, Fungal secondary metabolism: regulation and functions. In: A Century of Mycology (B. Sutton, ed.) pp.233-253, Cambridge University Press, Cambridge (1996). Fang, Keables and Demain, Unexpected enhancement of β -lactam antibiotic formation in *Streptomyces clavuligerus* by very high concentrations of exogenous lysine. Appl. Microbiol. Biotechnol. 44, 705 (1996). Demain, Breaking through gridlock on the aromatic thruway (to lower cost specialty chemicals) Nature Biotechnol. 14, 580 (1996). Gift, Park, Paradis, Demain and Weaver, FACS-based isolation of slowly growing cells: double encapsulation of yeast in microdrops. Nature Biotechnol. 14, 884 (1996). Azuma and Demain, Interactions between gramicidin S and its producer, *Bacillus brevis*. J. Indust. Microbiol. 17, 56 (1996). Rius, Maeda and Demain, Induction of L-lysine ϵ -aminotransferase by L-lysine in *Streptomyces clavuligerus*, producer of cephalosporins. FEMS Microbiol. Lett. 144, 207 (1996). Demain and Fang, Secondary metabolism: The new biotechnology frontier. In: Proceedings of Biotechnology Workshop (D. D.-Y. Ryu, S. S. Lee and M. H. Han, eds.), pp.1-12, Korean-American Scientists and Engineers Association, Rockville, MD. (1996). Fang, Pierson, Mishra, Koenig and Demain, Secondary metabolism in simulated microgravity: β -lactam production by *Streptomyces clavuligerus*. J. Indust. Microbiol. Biotechnol. 18, 22 (1997). Bykhovsky, Demain and Zaitseva, The crucial contribution of starved resting cells to the elucidation of the pathway of vitamin B12 biosynthesis. Crit. Revs. Biotechnol. 17, 21 (1997). Fang, Pierson, Mishra, Koenig and Demain, Gramicidin S production by *Bacillus brevis* in simulated microgravity. Curr. Microbiol. 34, 199 (1997). Romero, Martín, Liras, Demain and Rius. Partial purification, characterization and nitrogen regulation of the lysine ϵ -aminotransferase of *Streptomyces clavuligerus*. J. Indust. Microbiol. Biotechnol. 18, 241 (1997). Rius and Demain, Lysine ϵ -aminotransferase, the initial enzyme of cephalosporin biosynthesis in actinomycetes. J. Microbiol. Biotechnol. 7, 95 (1997). Fang and Demain, Influence of aeration and carbon source on production of microcin B17 by *Escherichia coli* ZK650. Appl. Microbiol. Biotechnol. 47, 547 (1997). Yashphe, Davis, Peng, Bok and Demain. New microorganism which convert compactin to pravastatin. Actinomycetologica 11, 20 (1997). Reynolds and Demain. Rapamycin, FK506, and ascomycin-related compounds. In: Biotechnology of Antibiotics, 2nd edition (W. R. Strohl, ed.), pp.497-520, Marcel Dekker, Inc., New York (1997). Fang, Pierson, Koenig, Mishra and Demain, Effect of simulated microgravity and shear stress on microcin B17 production by *Escherichia coli* and on its excretion into the medium. Appl. 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Piret and A.L.Demain, Elucidation of conditions allowing conversion of penicillin G and other penicillins to deacetoxycephalosporins by resting cells and extracts of *Streptomyces clavuligerus* NP1. *Proc. Natl. Acad. Sci. USA* 95: 11544-11548 (1998). G. Lancini and A. L. Demain, Secondary metabolism in bacteria: antibiotic pathways, regulation and function. In: *Biology of the Prokaryotes*. J. W. Lengeler, G. Drews and H. G. Schlegel, eds., pp. 627-651, Thieme, Stuttgart (1999). G. Ozcengiz, J.-H. Kim, W. R. Lin, E. Ozcengiz, D. Westenberg, L. R. Lynd and A. L. Demain, Superiority of the PCR-based approach for cloning the acetate kinase gene of *Clostridium thermocellum*. *J. Indust. Microbiol. Biotechnol.* 21: 145-149 (1998). W. R. Lin, Y. Peng, S. Lew, C. C. Lee, J. J. Hsu, J.-F. Hamel and A. L. Demain, Purification and characterization of acetate kinase from *Clostridium thermocellum*. *Tetrahedron* 54: 15915-15925 (1998). A. L. Demain, J. F. Martin and R. P. 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Elander, The β -lactam antibiotics: past, present, and future. *Antonie van Leeuwenhoek* 75: 5-19 (1999). J. L. Adrio, H. Cho, J. M. Piret, A.. L. Demain, Inactivation of deacetoxycephalosporin C synthase in extracts of *Streptomyces clavuligerus* during bioconversion of penicillin G to deacetoxycephalosporin G, *Enzyme and Microbial Technology* 25: 497-501 (1999). M.J.Fernandez, J.L.Adrio, J.M.Piret, S.Wolfe, S.Ro and A.L.Demain, Stimulatory effect of growth in the presence of alcohols on biotransformation of penicillin G into cephalosporin-type antibiotics by resting cells of *Streptomyces clavuligerus* NP1, *Appl. Microbiol. Biotechnol.* 52: 484-488 (1999). A.L.Demain, Pharmaceutically active secondary metabolites of microorganisms, *Appl. Microbiol. Biotechnol.* 52: 455-463 (1999). M.A.Baez-Vasquez, J.L.Adrio, J.M.Piret and A.L.Demain, Further studies on the bioconversion of Penicillin G into deacetoxycephalosporin G by resting cells of *Streptomyces clavuligerus* NP-1, *Appl. Biochem. Biotechnol.* 81: 145-152 (1999). A.L. Demain, Microbial biotechnology, *Trends Biotechnol.* 18: 26-31 (2000). A.Fang, G.K.Wong & A.L.Demain, Enhancement of the antifungal activity of Rapamycin by the coproduced Elaiophylin and Nigericin, *J.of Antibiotics*. 53: 158-162 (2000). A. Fang, D. L. Pierson, S. K. Mishra and A. L. Demain, Growth of *Streptomyces hygroscopicus* in rotating-wall bioreactor under simulated microgravity inhibits rapamycin production, *Appl. Microbiol. Biotechnol.* 54: 33-36 (2000). A. Fang, D. L. Pierson, S. K. Mishra and A. L. Demain, Relief from glucose interference in microcin B17 biosynthesis by growth in a rotating-wall bioreactor, *Lett. Appl. Microbiol.* 31: 39-41(2000). M. A. Baez-Vasquez and A. L. Demain, Immobilized *Streptomyces clavuligerus* NP1 cells for biotransformation of penicillin G into deacetoxycephalosporin G, *Appl. Biochem. Biotechnol.* 87: 135-140 (2000). W-S. Kim, Y. Wang, A. Fang and A. L. Demain, Methionine interference in rapamycin production involves repression of demethylrapamycin methyltransferase and S-adenosylmethionine synthetase. *Antimicrob. Agents Chemother.* 44: 2908-2910 (2000). Y. Peng and A. L. Demain, Bioconversion of compactin to pravastatin by *Actinomadura* sp. ATCC 55678. *J. Molec. Catalysis B: Enzymatic* 10: 151-156 (2000). A. L. Demain, Idiolites from microorganisms: a brilliant past, a bright future. In: *2000 Years of Natural Products Research-Past, Present and Future*. T. J. C. Luijendijk ed., pp. 15-39, Phytoconsult, Leiden (2000). A. L. Demain, Microbial natural products: a past with a future. In: *Biodiversity- New Leads for the Pharmaceutical and Agrochemical Industries*. S. K. Wrigley, M. A. Hayes, R. Thomas, E. J. T. Chrystal and N. Nicholson, eds., pp. 3-16, Royal Society of Chemistry, Cambridge (2000). A. L. Demain, Small bugs, big business: The economic power of the microbe. *Biotechnol. Adv.* 18: 499-514 (2000). A. L. Demain and A. Fang, The natural functions of secondary metabolites. In: *History of*

Modern Biotechnology I, A. Fiechter, ed., pp. 1-39, Springer, Berlin (2000). A. L. Demain, The changing face of industrial microbiology/biotechnology. In: Proceedings of the Symposium on New Directions in Biotechnology, pp. 1-6, Society of Biotechnology and Bioengineering of Japan, Osaka University (2000).

A. L. Demain, Edward P. Abraham, Cell-free systems and the fungal biosynthesis of beta-lactams. J. Antibiotics. 53: 995-1002 (2000). A. L. Demain and G. Lancini, Bacterial pharmaceutical products. In: Prokaryotes, An Evolving Electronic Resource for the Microbiological Community. M. Dworkin, ed-in-chief, Springer-Verlag, New York (2001). W. H. Strohl, H. B. Woodruff, R. L. Monaghan, D. Hendlim, S. Mochales, A. L. Demain and J. Liesch, The history of natural products research at Merck & Co., Inc. SIM News. 51 (1): 5-20 (2001). A. L. Demain, J. L. Adrio and J. M. Piret, Bioconversion of penicillins to cephalosporins. In: Enzyme Technologies for Pharmaceutical and Biotechnological Applications, H. A. Kirst, W-K Yeh and M. J. Zmijewski, Jr, eds., pp. 61-88, Marcel Dekker, Inc. New York (2001). A. L. Demain and A. Fang, Secondary metabolism in simulated microgravity. Chem Rec 1: 333-346 (2001). Q. Gao, A. Fang, D. L. Pierson, S. K. Mishra and A. L. Demain, Shear stress enhances microcin B17 production in a rotating wall bioreactor, but ethanol stress does not. Appl Microbiol Biotechnol 56: 384-387 (2001). Q. Gao, A. Fang. and A. L. Demain, Induction of microcin B17 formation in *Escherichia coli* ZK650 by limitation of oxygen and glucose is independent of glucose consumption rate. J Indust Microbiol & Biotechnol 26: 341-344 (2001). A. L. Demain, Molecular genetics and industrial microbiology-30 years of marriage. J. Indust. Microbiol. Biotechnol. 27: 352-356 (2001). Q. Gao and A. L. Demain, Improvement in the bioconversion of penicillin G to deacetoxycephalosporin G by elimination of agitation and addition of decane. Appl. Microbiol. Biotechnol. 57: 511-513 (2001). Q. Gao and A. L. Demain, Effect of solvents on bioconversion of penicillin G to deacetoxycephalosporin G. J. Antibiot. 54: 958-961 (2001). A. L. Demain, Relationship between universities and industry: the American university perspective. Food Technol. Biotechnol. 39: 157-160 (2001). Y. R. Cheng, J. Huang, H. Qiang, W. L. Lin, and A. L. Demain, Mutagenesis of the rapamycin producer *Streptomyces hygroscopicus* FC904. J. Antibiot. 54: 967-972 (2001). A. L. Demain, Biotechnology: an environment where microbiology, genetics and engineering meet. In: Current Studies of Biotechnology. II. Environment, Z. Kniewald, ed., pp. 1-11, Croatian Society of Biotechnology, Zagreb (2001). W.-S. Kim, L. Xu, D. Souw, A. Fang, and A. L. Demain, An unexpected inhibitory effect of rapamycin against germination of spores of *Bacillus brevis* strain Nagano. J Antibiot. 55: 650-654 (2002). M. Kitabatake, K. Ali, A. Demain, K. Sakamoto, S. Yokoyama, and D. Söll, Indolmycin resistance of *Streptomyces coelicolor* A3(2) by induced expression of one of its two tryptophanyl-tRNA synthetases. J. Biol. Chem. 277: 23882-23887 (2002). J. L. Adrio and A. L. Demain, Improvements in the formation of cephalosporins from penicillin G and other penicillins by bioconversion. Org. Proc. Res. & Devel. 6:427-433 (2002). J. L. Adrio, G. A. Hintermann, A.L. Demain and J. M. Piret, Construction of hybrid bacterial deacetoxycephalosporin C synthases (expandases) by in vivo homeologous recombination. Enzyme Microb. Technol. 31:932-940 (2002). S. Sanchez and A. L. Demain, Metabolic regulation of fermentation processes. Enzyme Microb. Technol. 31:895-906 (2002). J.F. Martin and A.L. Demain. Unraveling the methionine-cephalosporin puzzle in *Acremonium chrysogenum*. Trends Biotech. 20:502-507 (2002). A.L. Demain and P. Vaishnav, Regulation of β -lactam antibiotic biosynthesis by carbon sources. Chimica Oggi/Chemistry Today 20 (11-12):46-51 (2002). A. L. Demain and R. F. Wolfe, Marvin P. Bryant 1925-2000, A biographical memoir. In: Biographical Memoirs 81, pp. 3-34. The National Academy Press, Washington D.C. (2002). A. L. Demain, Prescription for an ailing pharmaceutical industry. Nature Biotechnol 20: 331 only (2002). Q. Gao and A. L. Demain, Improvement in the resting-cell bioconversion of penicillin G to deacetoxycephalosporin G by addition of catalase. Lett. Appl. Microbiol. 34: 290-292 (2002). W. Yang, E.A. Hartwig, A. Fang and A.L. Demain. Effects of carboxymethylcellulose and carboxypolymethylene on morphology of *Aspergillus fumigatus* NRRL 2346 and fumagillin production. Curr. Microbiol. 46: 24-27 (2003). Q. Gao, J.M. Piret, J.L. Adrio and A.L. Demain. Performance of a recombinant strain of *Streptomyces lividans* for bioconversion of penicillin G to deacetoxycephalosporin G, J. Indust. Microbiol. 30: 190-194 (2003). W. Yang, W.-S. Kim, A. Fang and A.L. Demain. Carbon and nitrogen source nutrition of fumagillin biosynthesis by *Aspergillus fumigatus*. Curr. Microbiol. 46: 275-279 (2003). W.-S. Kim, S. Davis, G. Wong and A.L. Demain. Nutritional studies on the growth of the rapamycin-producing *Streptomyces hygroscopicus*. J. Microbiol. Biotechnol. 13: 560-563 (2003). A.L. Demain. Herman Jan Phaff: professor, mentor, friend and colleague. Int. Microbiol. 6: 157-161 (2003). J.L. Adrio and A.L. Demain. Fungal biotechnology. Int. Microbiol. 6: 191-199 (2003). A. L. Demain and P. Vaishnav. Nitrogen regulation of biosynthesis of antibiotics and other secondary metabolic products. PharmaChem 2 (No. 10): 92-96 (2003). A. L. Demain and P. Vaishnav. Secondary metabolism in microbes and its control by phosphate and metals. SIM News 54: 104-113 (2004). A. L. Demain. The biopharmaceutical revolution. Chimica Oggi/Chemistry Today. 22 (Nos. 11-12): 41-44

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